MULTIMEDIA UNIVERSITY ™

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

ETM4116 – DATA AND MULTIMEDIA NETWORKING
(TE)

9 MARCH 2019
2:30 p.m. – 4:30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 4 pages with 3 questions only.
2. Attempt **ALL** questions. The distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

Question 1

a) Suppose users are sharing a 4 Mbps link. Also suppose each user transmits continuously at 1 Mbps when transmitting, but each user transmits only 20 percent of the time.

i. If circuit switching is used, how many users can be supported? [1 mark]

ii. Suppose packet switching is used and there are eight users. Find the probability that at any given time, four users are transmitting simultaneously. [3 marks]

iii. Under what condition will there be essentially a queuing delay or no queuing delay? [2 marks]

b) List five generic tasks that a layer can perform. Is it possible that the same tasks could be performed by different layers? [6 marks]

c) Identify whether the following application is using UDP or TCP services. [6 marks]

i. HTTP
ii. SNMP
iii. SMTP
iv. SSL
v. DHCP
vi. Traceroute

d) Which transport layer protocol can fulfill the requirements for each of the following network applications? Justify your answer and provide a candidate application for each X and Y application, respectively. [6 marks]

Table 1

Application	Bandwidth Time	Time Sensitive	Reliability
X	Minimum of 512 kbps	Yes	Loss-tolerant
Y	Elastic	No	No loss

e) Suppose two hosts, A and B, are separated by 10,000 kilometers and are connected by a direct link of R = 2,000,000bps. Suppose the propagation speed over the link is 2.5×10^8 meters/sec. Consider sending a file of 800,000 bits from Host A to Host B.

i. How long does it take to send the file, assuming it is sent continuously? [2 marks]

ii. Suppose now the file is broken up into 20 equal sized packets. Suppose that each packet is acknowledged by the receiver and the transmission time of an acknowledgment packet is negligible. Finally, assume that the sender cannot send a packet until the preceding one is acknowledged. How long does it take to send the file? [2 marks]

iii. Compare the results from (a) and (b). [2 marks]

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Question 2

a) Suppose that an institutional network is 100Mbps LAN and connected to 15Mbps access link to the public internet. Suppose the average object size is 750,000 bits and that the average request rate from the institution's browsers to the origin servers is 16 requests per second. Also suppose that the amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response is 3 seconds on average. Model the total average response time as the sum of the average access delay (that is, the delay from Internet router to institution router) and the average Internet delay. For the average access delay, use $\Delta/(1-\Delta\beta)$, where Δ is the average time required to send an object over the access link and β is the arrival rate of objects to the access link.

i. Find the total average response time. [6 marks]

ii. Now suppose a cache is installed in the institutional LAN. Suppose the miss rate is 0.4. Find the total response time. [7 marks]

b) Is it possible for a machine with single DNS name to have multiple IP addresses? Justify your answer. [3 marks]

c) Name any 3 non-proprietary Internet applications and the application layer protocols that they use. [6 marks]

d) Compare between TCP and UDP services. [8 marks]

Continued...

Question 3

a) Answer the following questions by considering Figure 3. Build a table to display the time at which the packets each arrive and leave the queue. Also identify what is the delay between its arrival and the beginning of the slot in which it is transmitted? What is the average of this delay over all 12 packets?

i) Assume a priority service, and assume that odd-numbered packets are high priority, and even-numbered packets are low priority. [6 marks]

ii) Now assume round robin service. Assume that packets 1, 2, 3, 6, 11, and 12 are from class 1, and packets 4, 5, 7, 8, 9, and 10 are from class 2. [6 marks]

iii) Now assume weighted fair queuing (WFQ) service. Assume that odd numbered packets are from class 1, and even-numbered packets are from class 2. Class 1 has a WFQ weight of 2, while class 2 has a WFQ weight of 1. [7 marks]

Figure 3

b) Suppose an analog audio signal is sampled 16,000 times per second, and each sample is quantized into one of 2048 levels. What would be the resulting bit rate of the PCM digital audio signal? [3 marks]

c) Streaming video systems can be classified into three categories. Name and briefly describe each of these categories. [10 marks]

d) List three disadvantages of UDP streaming. [6 marks]

e) Why is a packet that is received after its scheduled playout time considered lost? [2 marks]

End of Paper